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ABSTRACT

This study determines whether children who see an object hidden in a location in one space can retrieve an analogous object hidden in an analogous location in a different space. Participants were 16 31-months-old and 16 38-months-old children. After a familiarization experience, half the children observed a stuffed dog hidden in a room, tried to retrieve an analogous toy dog hidden in the "same" place in a model of the room, and then retrieved the toy hidden in the regular room. After familiarization, the other half of the subjects saw the object hidden in the model and retrieved first in the large-scale room and then in the model. Results revealed an extremely large developmental difference in the ability of the two age groups to use their representation for where they saw an object hidden in order to find a different object. Retrieval scores of "transitional" subjects with a mean age of 34 months fell between those of the younger and older age groups. Grouping of high, middle, and low subjects in the transitional group showed that high scorers performed like older children and low scorers performed like the younger. Generally, results showed that by 3 years of age children understand that one space can correspond to or represent another and can use their memory representation to guide their search behavior. These abilities emerge over a relatively short time span. (RH)

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RAPID CHANGE IN THE REPRESENTATIONAL CAPABILITY OF VERY YOUNG CHILDREN

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The research reported here has to do with the development of representational abilities in young children. This research grew out of work I have been doing for several years on the development of memory in children between one and three years of age. It started by my asking about the nature of the memory representation that guides young children's memory-based searching for a hidden object.

Let me first give you a little background information about the memory research. In order to study memory processes in toddlers, I have used a task that involves memory for location: Children have to remember where in the environment an object is hidden. The basic task is cast as a hide-and-seek game that the young child plays with an attractive stuffed animal. The child watches while a toy is hidden in a natural (distinctive) location in the environment. The types of hiding places used are common to almost all homes--behind a couch, under a chair, under a pillow on a chair, behind a door, and so forth. A delay interval is imposed, and at the end of the interval, the child is encouraged to retrieve the hidden toy. Our young subjects typically enjoy this game greatly.

I have used this hide-and seek task in several experiments. One thing that is crystal clear from these studies is that very young children are very good at this task: They are very good at remembering the location of a single attractive object that has been hidden in a natural or distinctive location. For 1-1/2 and 2-1/2-year-old children, the rate of errorless retrievals is

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generally around 80% or better. In fact, performance has been near ceiling in most studies.

Given that young children display such accurate memory in this situation, I started wondering about the nature of the memory representation that guides their retrieval of the hidden object. The rather simple question that I initially posed was whether the representation was relatively abstract or more concrete. That is, is the memory representation some verbal or other form of abstract encoding? Or is it more concrete and specific, for example, an image of the object and its hiding place or of the hiding event itself? I reasoned that if the memory representation were relatively abstract, then a child ought to be able to transfer that information to a slightly different context. If, on the other hand, the information about where an object is hidden were represented in some more concrete or specific form, then one would not expect the child to be able to use it in a different situation. A related, but different question--which actually reflects better the way I currently think about this research--is this: Whatever the exact nature of the child's representation, can the child translate that representation for use in a different context?

To pursue these questions, I decided to see whether a child who saw an object hidden in a location in one space could retrieve an analogous object hidden in an analogous location in a different space. Accordingly, we constructed a scale model of my laboratory. The laboratory room is furnished like a standard, albeit rather shabby, living room: It has a couch, armchair, small dresser, floor pillows, and a wall with bookshelves and

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cupboards. The model was constructed to scale and furnished with miniature versions of the pieces of furniture located in the real room: A couch (with a cover identical to that on the large couch), chair, dresser, floor pillows, and shelf unit.

The main goal of the study was to see if young children could use their representation of where they had seen an object being hidden to guide their search for a different object that they had not observed being hidden. Thus, the child watched while a toy was hidden in one space and then tried to find an analogous toy that had been hidden, without the child observing it, in the analogous space. Again, the idea was that a child could succeed in this task only if he had a relatively abstract representation or if he could in some way translate his original representation.

After a familiarization experience (which I will come back to later), half the children observed a stuffed dog (about 7 in high) hidden in the real room (for example, under the floor pillows). The child then went into the adjoining room in which the model was located to try to retrieve a miniature toy dog (about 1/2 in high). The miniature was hidden in the same place in the model as the larger toy had been in the large-scale room. After retrieving the miniature toy, the child then went back into the original room and was asked to retrieve the original toy, i.e., the toy that the child had actually seen hidden in the first place. This procedure was crucial. It served as a memory check: If the subject failed to retrieve the analogous toy, we wanted to know whether he just didn't remember where he had seen

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the original toy being hidden in the first place or whether some other problem was responsible for his retrieval failure.

The other half of the subjects received the opposite order: They watched as the miniature dog was hidden in the model, and they then tried to retrieve the larger toy hidden in the room. It turned out not to matter at all which order the child received: Performance was the same regardless of whether they saw the original toy hidden in the model or the room. Each child was given 4 trials, and each trial consisted of observing the toy hidden in one space (either the model or the room), retrieval 1 in the analogous space, and retrieval 2 (the memory check) in the original space.

There were 32 subjects, including a younger group of 16 21-month-olds (range = 20 to 22 months) and an older group of 16 28-month-olds (range = 26 to 29 months). Sex, age, and space (model or room) were completely counterbalanced.

The results are shown in Figure 1. As is apparent from the figure, there is a very large difference in the performance of the two age groups for Retrieval 1--the retrieval of the analogous toy. For the older subjects, this task presents no difficulty at all. Their rate of errorless retrievals is at the same high level as it is for Retrieval 2--the memory check involving retrieval of the original object that the subject saw being hidden.

In contrast, for the younger subjects, the task presents extreme difficulty. Indeed, they simply cannot do it. As can be seen from the level of performance shown in the figure, they almost never succeeded in retrieving the analogous object. The

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comparison between Retrieval 1 and Retrieval 2 for the younger subjects is extremely instructive. These children show the same high level of errorless retrievals of the original object as the older subjects. Thus, their problem does not have to do with remembering where the original object was hidden; their problem is in using that memory to find the object they had not seen hidden.

The data presented in Figure 1 thus show two things. First, there is an extremely large developmental difference in the ability of the two age groups to use their representation for where they saw an object hidden to find a different object. In fact, the level of performance is on the floor for the 21-month-olds and on the ceiling for the 28-month-olds. Second, the difficulty does not lie with the child's memory per se. Even the younger children know where the original object is, but they cannot use that knowledge to figure out where the analogous object must be.

One reason for this could be that the younger children do not understand the relationship between the real, large-scale room and the small-scale model. They might not realize that the locations in the model represent the comparable locations in the room.

Support for this supposition comes from the familiarization trials that were provided to all the subjects at the beginning of the session. In these trials, extensive efforts were made to establish for the child the correspondence between the two spaces and the objects. The child was told, "This is Daddy Snoopy, and

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this is his big room. This is Baby Snoopy, and this is his little room." The correspondence between the items of furniture was explicitly pointed out. ("This is Daddy Snoopy's couch, and this is Baby Snoopy's little couch.) The experimenter held each piece of miniature furniture from the model up against the corresponding item in the room as she described the correspondence between them. Next, the experimenter placed one of the toys in one of the spaces, and she tried to get the child to place the other toy in the corresponding location. ("Daddy Snoopy is sitting in his chair. Can you put Baby Snoopy on his chair.") Finally, the experimenter hid one toy in its space and tried to get the child to hide the second toy in the comparable location in the other space. ("Daddy Snoopy is going to hide in his cupboard. Can you help Baby Snoopy hide in the same place.")

When we look at the younger children's response to these familiarization trials, it is clear that they never really understood the correspondence, in spite of the lengths we went to to help them get it. They very rarely were able to imitate the experimenter's placement or hiding of the objects. In contrast, the older children almost always performed appropriately on these trials.

Because there was such a sharp dichotomy between the performance of the 31- and the 38-month-old groups of children, I decided to examine in more detail a group of children in between these two ages, that is, a group that might be expected to be transitional in the development of these abilities. Accordingly, we observed a group of 16 children between the ages of 33 and 35 months (mean age = 34 months).

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Figure 2 shows the retrieval performance of this group, in comparison to the older and younger groups observed in the first study. As you can see, this group does lie in between the other two, although it is clearly much closer to the younger than to the older group.

To try to get a better idea of what was going on in this group, we examined the response patterns of individual subjects. The 16 subjects were divided into three groups on the basis of their behavior on the familiarization trials and their response to the prompts that they received whenever they failed to retrieve the analogous toy on Retrieval 1. In such cases, the experimenter provided a nonspecific prompt that was designed simply to remind the child of the correspondence: "Remember where Daddy Snoopy is hiding; Baby Snoopy is hiding in the same place."

Six children were classified as understanding the correspondence, because they performed correctly on the familiarization trials, and they benefitted from the prompts they received. Other evidence also indicated the extent of these subjects' comprehension of the correspondence. During the familiarization phase, some of them actually anticipated the experimenter's explanation of the relation between the room and the model: One child commented, "They're the same," and another started explaining the relationship to the experimenter. In addition, some of the children in this group displayed a very interesting strategy that revealed their understanding. Occasionally, during Retrieval 1, a child who appeared puzzled as

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to the relevant location would return to the original space, visually seek out the hiding place, and then go immediately back and retrieve the toy. It was clear that these children were looking back at the original space to remind them of where the toy had been hidden, so they could then go to the appropriate analogous location.

Another group of 5 subjects was classified as not understanding the correspondence: They were almost never correct on the familiarization trials, and they never responded to the prompts. A third group of 5 children was considered to be transitional: These children generally did poorly on the familiarization trials, but they were able to use the prompt to help them find the toy.

Figure 3 shows the retrieval data for these three groups of subjects. The Correspondence (+) group looks just like the older children in the previous experiment, and the Non-correspondence (-) group resembles the younger subjects. The transitional subjects are children who give some signs of beginning to grasp the correspondence even though they cannot produce errorless retrievals.

This analysis of the intermediate age group thus in some ways makes the development of the representational skills studied here look even more discrete than it did in the first study. These data suggest that the majority of the change may occur within 3 or 4 months rather than 6 or 7. At the same time, we do see children who are in transition. They seem to be getting part of what is going on, but certainly not all of it.

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So what do we know from these two studies? I think we have learned something about the early development of representation. We know that by 3 years of age children understand that one space can correspond to or represent another. We also know that these same children can use their memory representation of the hiding of one object to guide their search for another, different object in a different space. In a sense, the 3-year-olds are able to use their representation of one event to reason about a different, unseen event: on the basis of where they saw one object hidden, the children infer where the other object must be.

In addition, we know that these abilities emerge over a relatively short time span. Children go from a virtual absence of any understanding of the correspondence between the two spaces at 2-1/2 years of age to a well developed understanding by the age of 3, six months later.

I have emphasized the suddenness of this change, the apparent discontinuity in the children's abilities. It is quite possible that, as is so often the case with apparently stage-like transitions, when we look more closely we may find more continuous progress than is apparent at the moment.

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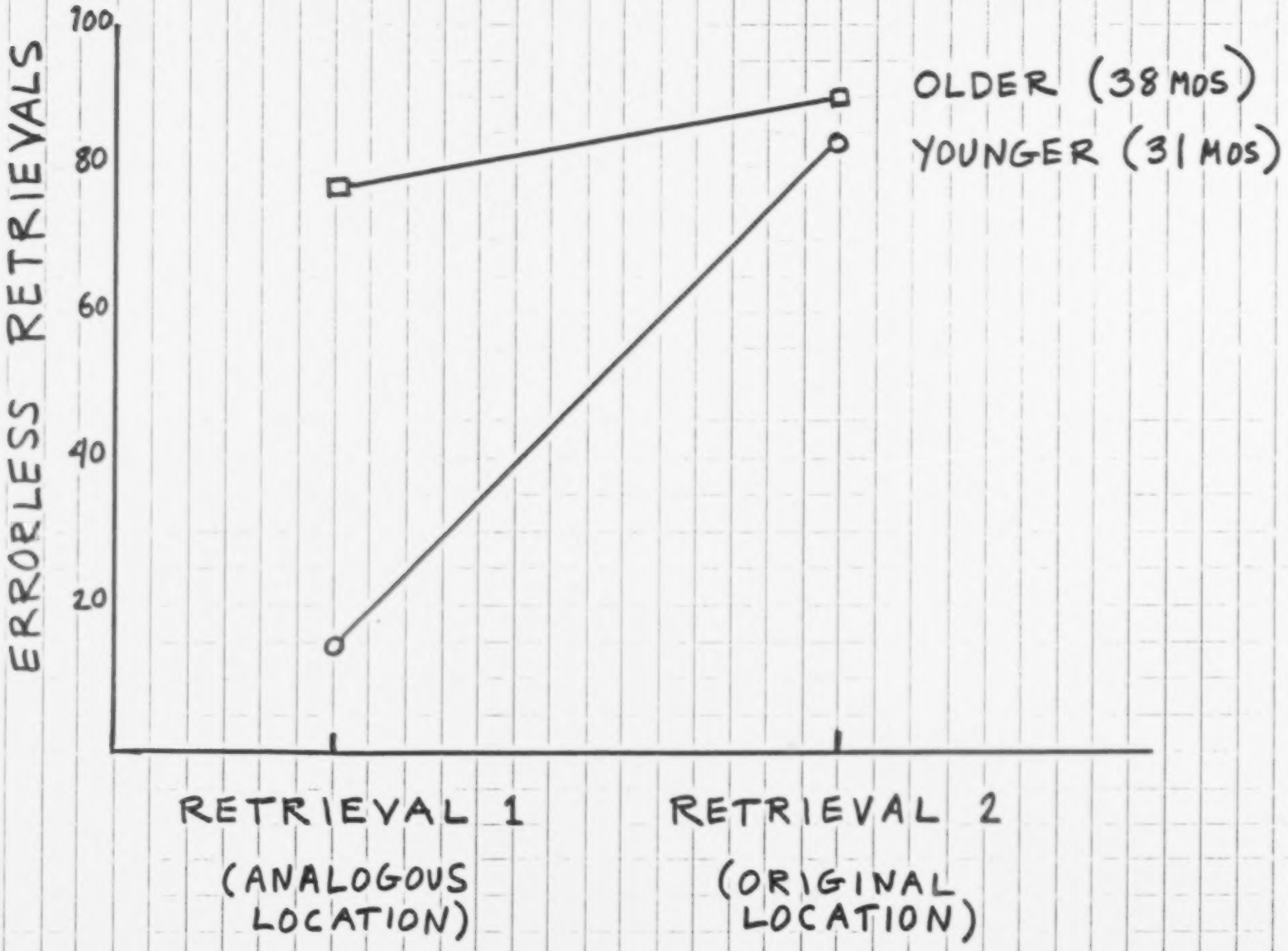

Figure 1

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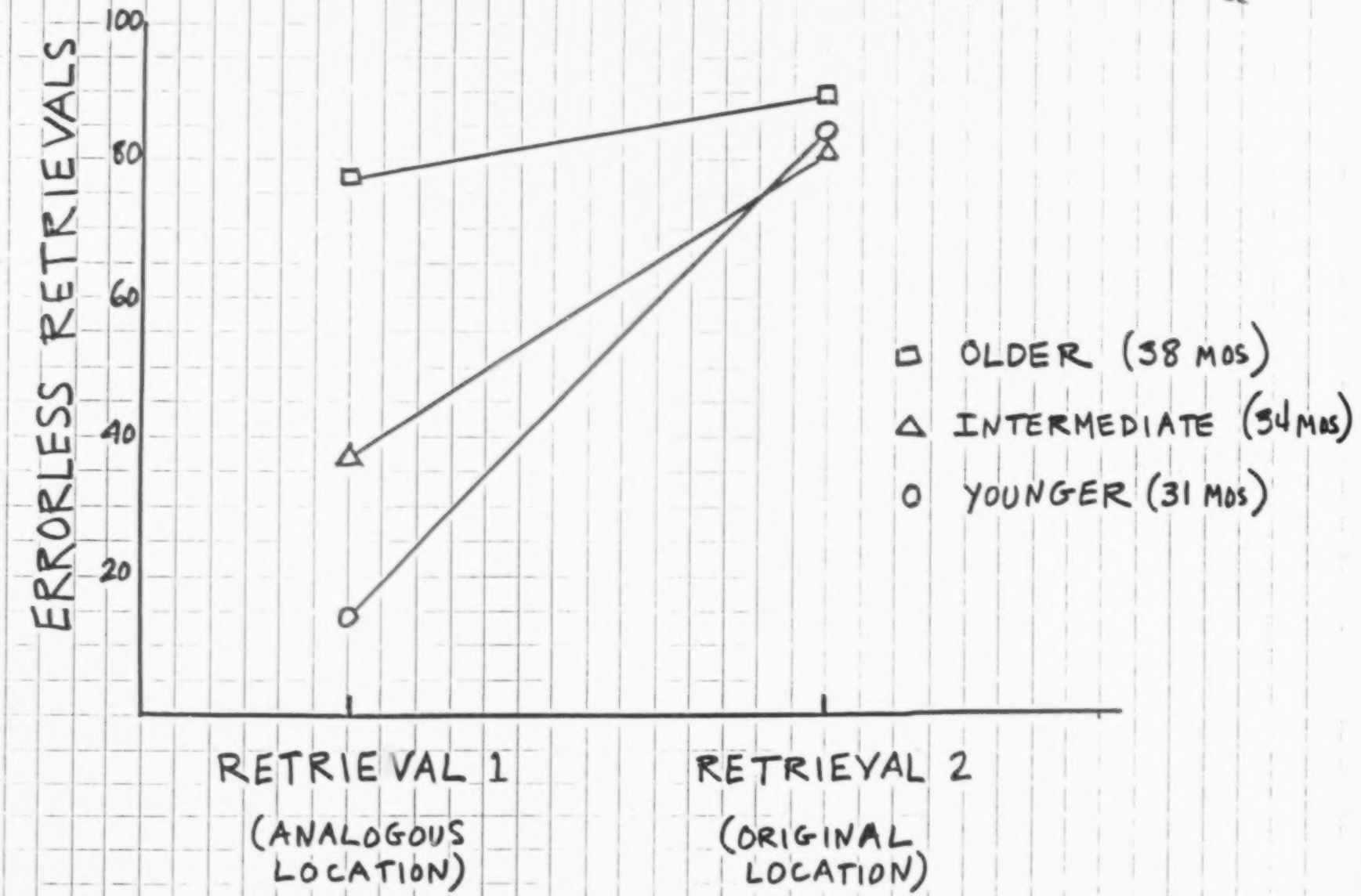

Figure 2

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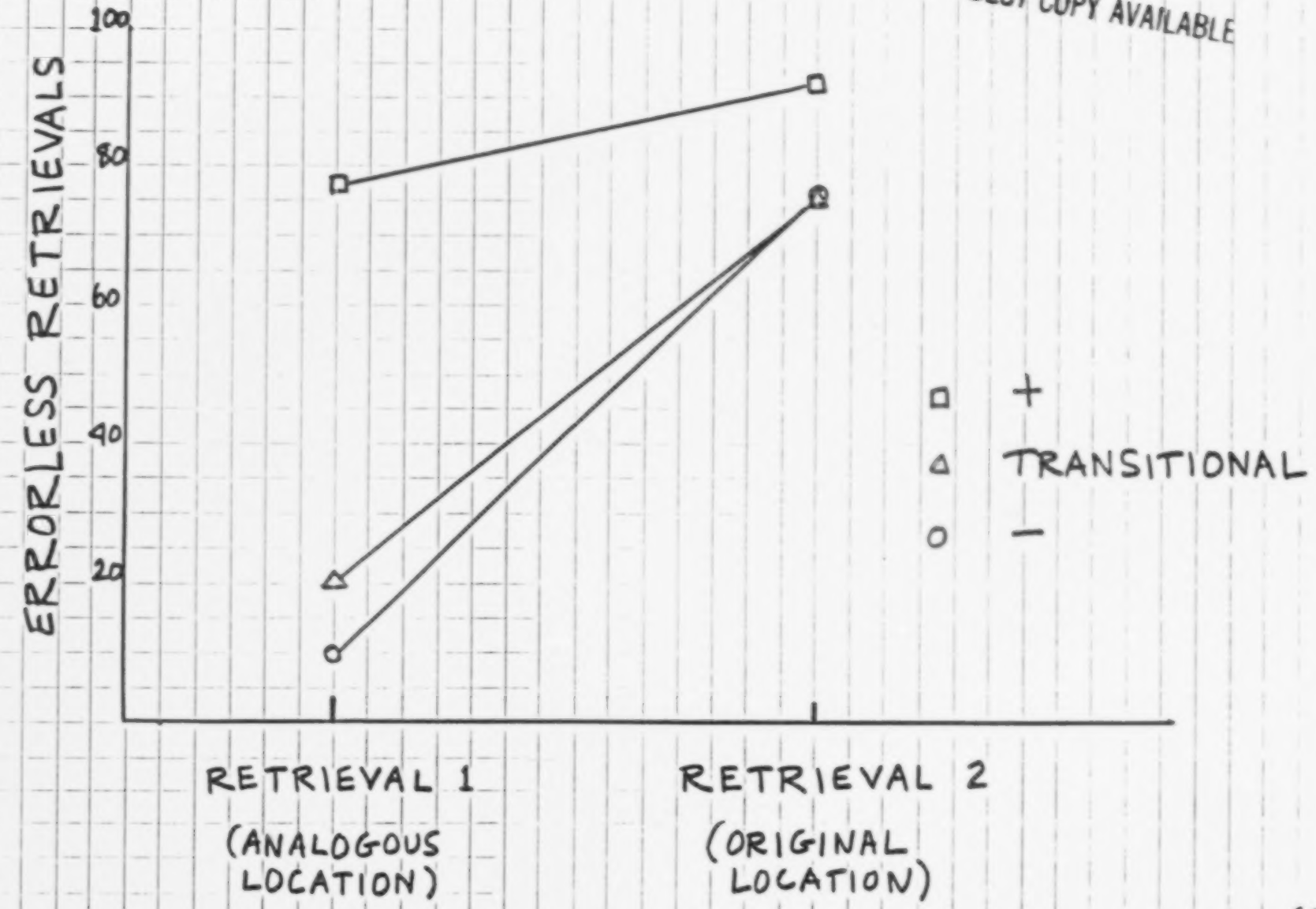

Figure B